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Strengthening national health laboratories in sub-Saharan Africa: a decade of remarkable progress

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Abstract

OBJECTIVES Efforts to combat the HIV/AIDS pandemic have underscored the fragile and neglected nature of some national health laboratories in Africa. In response, national and international partners and various governments have worked collaboratively over the last several years to build sustainable laboratory capacities within the continent. Key accomplishments reflecting this successful partnership include the establishment of the African-based World Health Organization Regional Office for Africa (WHO-AFRO) Stepwise Laboratory Quality Improvement Process Towards Accreditation (SLIPTA); development of the Strengthening Laboratory Management Toward Accreditation (SLMTA) training programme; and launching of a Pan African-based institution, the African Society for Laboratory Medicine (ASLM). These platforms continue to serve as the foundations for national health laboratory infrastructure enhancement, capacity development and overall quality system improvement. Further targeted interventions should encourage countries to aim at integrated tiered referral networks, promote quality system improvement and accreditation, develop laboratory policies and strategic plans, enhance training and laboratory workforce development and a retention strategy, create career paths for laboratory professionals and establish public–private partnerships. Maintaining the gains and ensuring sustainability will require concerted action by all stakeholders with strong leadership and funding from African governments and from the African Union.

Keywords

collaboration with partners; remarkable progress; Strengthening national laboratories; sub-Saharan Africa

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Introduction

National health laboratories are unique in that they cut across all areas of every country's national health systems delivery. Their core roles and functions are to provide timely, accurate and reliable results to support diagnosis, surveillance and outbreak investigations. In sub-Saharan Africa, there has been a neglect of some national health laboratories that inhibits their ability to immediately manage pandemic diseases of public health importance as soon as they occur (World Health Organization (WHO) 2006a,b; Nkengasong *et al.* 2010).

The outcome of this neglect has been persistently high levels of laboratory error and lack of functioning quality management systems and accreditation of the majority of these national health laboratories (Amexo *et al.* 2004; Gershy-Damet *et al.* 2010). This resulted in lack of confidence in laboratory services by physicians and other care providers (Amexo *et al.* 2004; Bates *et al.* 2004; Petti *et al.* 2006; Polage *et al.* 2006). However, within the past 10 years, there have been renewed efforts to strengthen laboratory systems and networks by African governments and regional and international partners such as the East Africa Public Health Laboratory Network Project, World Health Organization (WHO), the US President's Emergency Plan for AIDS Relief (PEPFAR), the Clinton Health Access Initiative (CHAI), the World Bank, and the Global Fund to Fight AIDS, Tuberculosis and Malaria (GFATM). The focus has been to leverage resources, set up integrated laboratory services and systems, develop comprehensive national laboratory policies and strategic plans for tiered laboratory networks, quality system improvement and accreditation preparedness schemes (World Health Organization (WHO) 2006a,b; Lantos & Hyde 2008; Nordling 2009; Gershy-Damet *et al.* 2010; Nkengasong *et al.* 2009; Parsons *et al.* 2012).

Some examples of recent landmark achievements from the initiative (African governments, PEPFAR, WHO, and international partners) include the launching in 2009 in Kigali, Rwanda, of the WHO-AFRO Stepwise Laboratory Quality Improvement Process Towards Accreditation (SLIPTA) framework and the Strengthening Laboratory Management Towards Accreditation (SLMTA) programme to provide a more user-friendly and amenable approach to achieving laboratory quality improvement and accreditation (Wenner 2009; Yao *et al.* 2010). This was followed in 2011 with the establishment of the African Society for Laboratory Medicine (ASLM) in Addis Ababa, Ethiopia, with its primary role being to advocate, support and strengthen medical laboratories in Africa (African Society for Laboratory Medicine (ASLM) Launched 2011). These events together with other landmark meetings (Table 1) that have taken place on the continent could serve as important advocacy tools in bringing the predicament of laboratory services and systems to the attention of policymakers.

There is evidence that some past health gains in sub-Saharan Africa have been reversed due to poor or weak functional health systems and little support from policymakers (World Health Organization (WHO) 2006b; Chopra *et al.* 2009). Hence, there is a compelling need for governments, ASLM, the African Union, and other regional and international partners to collaborate and ensure effective strengthening and sustainability of current gains. In this article, we present an analysis of past laboratory situation, attempt to describe the journey of national health laboratories advancement in sub-Saharan Africa and provide some

suggestions that could be followed to ensure quality system improvement and long-term sustainability of current investments.

Methodological approach

We conducted electronic searches in PubMed, supplemented by the authors' knowledge of other relevant resources, such as the WHO-AFRO and ASLM websites and conference abstracts. The authors also exploited decades of experience working with ministries of health and partners in strengthening laboratory systems in sub-Saharan Africa. The search themes included national laboratories in sub-Saharan Africa, collaboration with partners, outcomes and improvement in laboratory quality systems. Particular emphasis was on gaps in laboratory quality systems, improvements made, sustainability, workforce and public–private partnership. The first step involved screening of articles by reviewing the abstracts and titles. Articles were selected for full appraisal if they have any information relevant to national health laboratories within the past decade. Additionally, cited references from identified articles were also searched for more information relevant to the subject. Overall judgment of all studies ensured that bias and confounding factors could not influence the information presented. The information gathered was grouped into different sections of this review article, showing past laboratory situation and achievements following collaborations with local and international partners. As a result, many accomplishments realised were identified and highlighted with four salient examples, namely policy and advocacy events, WHO-AFRO SLIPTA Framework, SLMTA Training Programme and establishment of the ASLM Secretariat selected for demonstration purposes.

Past laboratory situation in Africa

More than 70% of clinical decision-making is predicated upon, confirmed by, or documented by medical laboratory test results (Dighe *et al.* 2007). Also, the laboratory has been identified as one of six key public health functions that would contribute the most towards health systems strengthening efforts and has the greatest impact on improving the public's health (Bloland *et al.* 2012). Despite this recognition, there were still gaps in the strengthening of laboratory services and systems in some African countries, such as poor laboratory infrastructure, lack of laboratory networks, equipment or their maintenance, shortage of well-trained laboratory staff and weak supply chain management systems (Olmsted *et al.* 2010; Abimiku *et al.* 2010; Fonjungo *et al.* 2012). These issues cumulated in a myriad of organisational, functional and professional challenges within the laboratory health system in the continent. Some examples are demonstrated below.

Lack of trust in laboratory results

Past evidence suggests that poor laboratory health systems strengthening in Africa led to major setbacks in the quality of testing for patient management of many diseases (Birx *et al.* 2009; Hailegiorgis *et al.* 2010). For instance, there was an over-diagnosis of malaria with many false-positive results being reported in some public health facilities in Dar es Salaam, Tanzania (Kahama-Maro *et al.* 2011). This may partly account for the over reliance on a presumptive and/or syndromic approach. Also, despite increased availability of laboratory services in Ghana, physicians still rely on clinical judgment and empirical therapy: a

physician's poor perception of the value of laboratory diagnostic testing was the major barrier to laboratory use, which led to the disproportionate administration of antibiotics with undue cost to patients (Polage *et al.* 2006). There is therefore a need to better strengthen laboratory systems to build confidence and improve the clinic–laboratory relationship.

Vertical approach to laboratory health systems strengthening

Earlier interventions by global health partners to strengthen laboratory systems in Africa were more disease specific and based on the emerging disease in question. This was evident during the emergence of the HIV/AIDS pandemic, where some countries established national HIV and AIDS specific laboratories. There are indications that this disease-specific (vertical) approach to operating laboratories overwhelmed many public health laboratory services already burdened with human resource shortages, an ageing and inadequate infrastructure, and a lack of quality systems (Annex 2009; Nkengasong *et al.* 2010). Implementing strategies where possible that ensure leveraging resources to strengthen the entire health system and not specific diseases is beneficial and cost effective (Alemnji *et al.* 2012; Parsons *et al.* 2012). It should be noted, however, that integration of laboratory services and systems may not be possible at all levels, including the peripheral levels that do not have the capacity to support such systems. In this case, it is important that all laboratories in country should exist within a national laboratory network.

Lack of functional laboratory networks

To improve access to health care and treatment services at the central and peripheral levels, laboratory networks need to be established and strengthened. Despite the benefits of tiered laboratory networks, laboratories in most African countries lacked clear lines of function, authority and responsibility from a central national health laboratory to primary health centres (Trevor *et al.* 2009). There were few countries with national quality systems and/or policy, tiered laboratory networks, standards for laboratory tests and personnel, referral hubs for advanced tests, and guidelines to achieve and maintain harmonised and acceptable standards (Nkengasong *et al.* 2009; Trevor *et al.* 2009). A functional laboratory network including sample referral is necessary, particularly on the African continent, where laboratory capacity is not the same at all levels (Alemnji *et al.* 2011; Carter *et al.* 2012). In this tiered structure, laboratories with less capacity will have the opportunity to collect and refer samples requiring more sophisticated testing to other laboratories that have the capacity to test and to send back results within an acceptable turnaround time. This provides an opportunity for patients located in remote areas to benefit from high-technology laboratory tests without physically leaving their environment Carter *et al.* (2012).

Limited quality system improvement and accreditation attempts

Achieving practical and sustainable laboratory accreditation was a major challenge in Africa owing to lack of leadership, attention, resources and commitment (Opio *et al.* 2010; Elbireer *et al.* 2013). Despite these challenges, of the over 340 accredited laboratories in Africa, 312 (92%) were located in South Africa alone (Abimiku 2012). South Africa is a country with a national accreditation body; the South African National Accreditation System. This suggests that the presence of in-country accreditation institutions could have an important role in promoting quality system improvement and laboratory accreditation. Outside South Africa,

accreditation has mostly been achieved in private laboratories or where there is involvement of external funding (Zeh *et al.* 2010). The accreditation approach has not been user-friendly, as most laboratories found it difficult to achieve quality improvement and accreditation as a package without employing a staged or stepwise approach (Gershy-Damet *et al.* 2010; Yao *et al.* 2010). There was a need for a change to a laboratory quality system implementation and accreditation strategy in Africa to obtain more tangible and measurable results.

Turning point in laboratory health systems strengthening

Issues surrounding laboratory health systems strengthening in Africa reached a tipping point that warranted urgent intervention. For example, the emergence of the HIV/AIDS epidemic exposed the fragile nature of some laboratory systems, as they were not equipped to support HIV prevention, treatment and care programmes. There was the need to place more emphasis on national health laboratory systems strengthening to meet the challenges of this disease. As a result of these efforts, some remarkable accomplishments have been noted and have benefitted multiple diseases within national health laboratories in many countries in Africa as demonstrated below.

Policy and advocacy events

Developing strategies to raise awareness on the impact and importance of improved laboratory quality systems in Africa has been a huge challenge because the impact of laboratory errors on health services has not been systematically analysed and presented to policymakers. This may partly explain why it took a long time for African leaders and international partners to consider focusing more attention on strengthening public health and clinical laboratories. The improvements in laboratory services and systems in the past decade in sub-Saharan Africa can be linked to some key declarations and also to outcomes and impact of some landmark policy and advocacy meetings (Table 1). More of such advocacy events are recommended to ensure continued support and investment in the national health laboratory sector. Furthermore, accreditation of select laboratories, and showing the benefits of accreditation, could be an important advocacy tool (Zeh *et al.* 2010).

The WHO-AFRO SLIPTA framework

The launching of the WHO-AFRO SLIPTA framework has also played a key role among governments and other laboratory stakeholders in the region in raising awareness on the importance of the laboratory accreditation (Wenner 2009; Maruta *et al.* 2012). This process has demonstrated that implementation of a stepwise accreditation preparedness approach can be user-friendly, attractive to all laboratory tiers and developmentally focused while providing a useful mechanism for identifying resource, training, system strengthening needs and target areas for specific interventions (Gershy-Damet *et al.* 2010). Many African states are undertaking changes to strengthen their national laboratory systems (Zeh *et al.* 2010; Audu *et al.* 2012). These improvements, partially stimulated by the WHO-AFRO stepwise accreditation preparedness initiative, have been accompanied by an increase in the number of laboratories in the continent that are engaged in the accreditations process (Mothabeng *et al.* 2012; Maruta *et al.* 2012). With this framework in place, it is anticipated that many more laboratories will embark on the pathway of accreditation in sub-Saharan Africa.

The SLMTA training programme

Another important milestone in laboratory quality system improvement in Africa has been the launch and implementation of SLMTA and laboratory mentorship programmes (Yao *et al.* 2010; Mothabeng *et al.* 2012; Maruta *et al.* 2012) that have completely revolutionised laboratory quality thinking in sub-Saharan Africa. SLMTA is a mentoring and training programme designed to effect immediate and measurable improvement in laboratory quality and services using minimal resources. It was launched in 2009 to equip laboratory management with the knowledge to implement quality improvement using the SLIPTA scale (Wenner 2009). Each laboratory participating in SLMTA is audited in the beginning (baseline) and at the end (exit) using the SLIPTA checklist. Laboratories that acquire the fifth star on the SLIPTA checklist rating are considered ready to apply for international accreditation. Between 2009 and the present, about 37 countries have participated in SLMTA and over 400 laboratories have been enrolled in the programme with remarkable results (Strengthening Laboratory Management Towards Accreditation (SLMTA) Symposium 2012). Lesotho, the first country that adopted SLMTA, has graduated two cohorts, enrolling 18 of 19 laboratories in the country. All but one enrolled laboratory showed measurable improvements, and seven were selected for SLIPTA audit (Mothabeng *et al.* 2012). As mentioned above, 92% of all laboratories accredited in sub-Saharan Africa are in South Africa. The current accelerated improvement in laboratory quality systems in the rest of the countries as a result of the SMLTA programme may soon lead to an increase in the number of laboratories accredited to international standards. Despite having been established only a few years ago, the SLMTA programme has moved beyond improvement in laboratory quality systems to be applied to improving hospital administrative systems in some countries (Strengthening Laboratory Management Towards Accreditation (SLMTA) Symposium 2012).

Establishment of the ASLM secretariat

Establishing laboratory professional bodies to advocate for the importance and need for strengthening laboratories is critical. The ASLM Secretariat was established to assume this function (African Society for Laboratory Medicine (ASLM) Launched 2011).

To improve advocacy and ownership for sustainability, ASLM is expanding and launching national ASLM offices in different countries as well as using laboratory advocates as ambassadors to communicate laboratory good practices. For example, the first ASLM local office was recently established in Botswana to build in-country laboratory capacity and to chart the way towards quality system improvement and accreditation (African Society for Laboratory Medicine (ASLM) 2012a). ASLM has established an official peer-reviewed journal, the African Journal of Laboratory Medicine (African Journal of Laboratory Medicine (AJLM) 2012). AJLM serves as a repository for cutting-edge research that focuses on the role of the laboratories and laboratory professionals in clinical care and public health on the African continent. ASLM hosted its first international conference in December 2012 in Cape Town, South Africa African Society for Laboratory Medicine (ASLM) (2012b). This meeting brought together over 1000 laboratory professionals, clinicians, programme managers, epidemiologists, researchers, students and policymakers to present and discuss

the latest developments and initiatives for strengthening national laboratory health systems and networks.

Sustainability

The recent and steady gains in improvement in laboratory quality systems on the African continent are encouraging and demonstrate that further gains are possible, especially in partnership with stakeholders and with commitment from national and regional governments. It is critical that these gains are maintained for sustainable quality laboratories. Strategies needed to maintain these hard-earned gains include the following.

In the past, African countries have relied much on donor funds to strengthen public health laboratories and other health systems. Sustaining such support is currently threatened by the global recession, relative economic hardship in donor nations and competing demands of health and other national agendas. African countries need to take greater responsibility for public health laboratory challenges and rely less on the global community. In this regard, a partnership between international institutions and African governments in strengthening their laboratory system is critical. Such an arrangement should have a very clear operational budget and a transition plan to local ownership beyond donor funding. There is also the need for better collaboration between African countries and donor and implementing partners to ensure better capacity building of indigenous or African-based institutions.

Sustainability of laboratory systems in Africa is also threatened by an acute shortage of health workers who have left the continent for a variety of reasons (Chankova *et al.* 2009; Olmsted *et al.* 2010). It is estimated that while sub-Saharan Africa has 24% of the global disease burden, it has only 3% of the world's health workers (World Health Organization (WHO) 2006b). Strategies for human capacity development and staff retention, such as adequate compensation, training opportunities, improvements in the work environment through infrastructure renovation, and opportunities to participate in competitive grant writing and operational research, should be encouraged. African-based training institutions with programmes tailored towards African needs are highly recommended as this provides an opportunity for Africans to lead the process and to develop sustainable strategies that encourage staff retention.

An integrated laboratory strengthening approach and the establishment of national laboratory networks should be encouraged to ensure better coordination and effective utilisation of available resources. Where appropriate, broader implementation strategies that fit into and target the needs of the country's National Public Health Laboratory in line with its laboratory strategic plan should be encouraged. That way, disease- or programme-specific funding can benefit other less funded but country-priority disease areas.

Development of career profiles and representation of laboratory experts at decision-making levels will be very important. There is the need for ASLM and the African Union, together with its governments, to assist in establishing in-country medical laboratory councils as seen with other health professions, and to work with training institutions to develop training curricula that provide a clear path for medical laboratory professionals. Furthermore, the appointment of laboratory professionals and their representation at policy levels are

necessary as their input will be important in making decisions that would positively impact the national health systems.

The establishment of public–private partnerships (PPPs) to improve and sustain quality laboratory efforts is also necessary. Public–private partnerships combine the resources of government with those of the private sector to deliver socially beneficial goals such as improving the conditions of laboratories, strengthening laboratory systems and the skills of laboratory personnel. An example of a PPP that has been leveraged to meet some of the challenges and improve laboratories is the Becton Dickinson (BD)-PEPFAR PPP. Through this partnership, BD worked directly with Ministries of Health and other PEPFAR partners to develop country-specific work plans and to provide technical assistance to achieve the goals of the work plan (PEPFAR-BD 2007, 2012). More PPPs like this should be encouraged, especially with indigenous African private sector partners.

Conclusion

The neglect of some public health laboratories in Africa resulted in poor quality of laboratory services and ultimately the lack of trust and utilisation of laboratory results by physicians and other health officials. However, the synergistic efforts of global health partners, national and regional bodies, and governments have resulted in increased awareness and the development of frameworks, tools and processes to support strengthening of laboratory systems and services in sub-Saharan Africa. In particular, the implementation of the SLMTA programme and the WHO-AFRO/SLIPTA process coupled with the successful launch of ASLM as a platform to advocate for evidence-based quality improvement programmes for laboratory within the continent have played catalytic roles. To ensure expansion and sustainability of current gains, government involvement, improved coordination and communication between ASLM and laboratory structures in various counties are essential. Finally, innovative and well-coordinated commitments must be sought from African states and other stakeholders in building sustainable quality systems for public health laboratory services and systems in sub-Saharan Africa.

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Table 1

Some past landmark Laboratory Policy events: the outcomes and impact of these meetings have played significant role in addressing laboratory strengthening challenges in Africa

Event	Date	Outcome	Impact	References
Maputo declaration in Mozambique	January 2008	The Maputo declaration to strengthen laboratory systems in developing countries was issued	Standardisation of laboratory systems Develop and implementation of laboratory networks	World Health Organization (WHO) (2008a); Trevor *et al.* (2009)
WHO-CDC Lyon meeting in France	April 2008	It was recommended that countries with limited resources consider taking a staged approach, while more advanced and national reference laboratories were encouraged to aim at meeting internationally accepted standards such as ISO 15189	Launch of the WHO-AFRO SLIPTA process Implementation of the stepwise quality management system and accreditation	World Health Organization (WHO) (2008b); Wenner (2009); Zeh *et al.* (2010); Gershy-Damet *et al.* (2010)
WHO Yaoundé declaration in Yaoundé, Cameroon	September 2008	It resolved the urgent need to strengthen public health laboratories in all levels of health care. It also advocated support for member states by WHO-AFRO towards mobilising and sustaining resources with a view to strengthen laboratory services	Enhance in-country laboratory infrastructure Launch of the ASLM as an institution to strengthen quality laboratory services	World Health Organization (WHO) (2008c): Abimiku *et al.* (2010)
Senegal meeting in Dakar	September 2008	An agreement was developed encouraging laboratories to broaden their scopes from focusing on single disease to several diseases to allow for integrated networking.	Integrated laboratory system strengthening for diseases other than HIV including non-communicable diseases	Parsons *et al.* (2012)
Rwanda meeting in Kigali	July 2009	The WHO-AFRO SLIPTA and the Strengthening Laboratory Management towards Accreditation (SLMTA) were launched	Practical implementation of quality management system at all tier level using the stepwise approach Utilisation of a task-based tool (SLMTA) for quality system improvement and accreditation	Wenner (2009); World Health Organization (WHO) (2009); Yao *et al.* (2010); Zeh *et al.* (2010); Mothabeng *et al.* (2012)
ASLM launched in Addis Ababa, Ethiopia	March 14–16, 2011	The African Society for Laboratory Medicine was launched	Successfully launched African Journal for Laboratory Medicine for strengthening of laboratory services and systems and dissemination of scientific findings Training on competitive grant writing Promote accreditation of laboratory	African Society for Laboratory Medicine (ASLM) Launched (2011)
ASLM 2012 Conference, Cape Town South Africa	December 1–7, 2012	This conference brought together over 1000 laboratory professionals and other stakeholders to present and discuss the latest developments and initiatives for strengthening national laboratory health systems and networks	Networking by laboratory professionals, clinicians, policymakers and other on initiatives for strengthening national laboratory health systems and networks Bridging clinician-laboratorian gap Palpable momentum on several laboratories undergoing SLMTA and SLIPTA Laboratory workforce initiative	African Society for Laboratory Medicine (ASLM) (2012b)